WINNEBAGO LANDFILL

ROCKFORD, ILLINOIS

NORTHERN EXPANSION
LANDFILL GAS COLLECTION AND CONTROL SYSTEM
DESIGN PLAN

Prepared for

WINNEBAGO LANDFILL COMPANY, LLC

Winnebago Reclamation Service, Inc.

Winnebago Reclamation Service, Inc.

September 2009

Prepared by

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CONTENTS

CONTENTS (Continued)

APPENDICES

TABLE 1 SUMMARY OF LANDFILL GAS COLLECTION AND CONTROL SYSTEM DESIGN PLAN

Regulatory Citation	*Report Reference*	*Appendix E Reference* [1]	*Regulatory Requirement*	*Implementation of Regulatory Requirement*
§60.759 (a)(1)	Section 1.3	Page E-3, Section 2	Landfill gas collection and control system design plan must be certified, sealed and signed by a professional engineer.	Landfill gas collection and control system design plan has been certified, sealed and signed by a professional engineer.
	Section 4-1	Page E-3, Section 3	Design Plan must address depth of refuse, refuse gas generation rates and flow characteristics, cover properties, gas system expandability, leachate and condensate management, accessibility, compatibility with filling operations, integration with closure end-use, air intrusion control, corrosion resistance, fill settlement, resistance to the refuse decomposition heat.	The Winnebago Landfill design plan addresses all of the requirements listed under §60.759 (a)(1).
§60.759 (a)(2)	Section 4-2	Page E-3, Section 4	Landfill gas collection devices shall be installed at a sufficient density to control surface emissions and subsurface migration of landfill gas.	The current landfill gas collection devices have been designed to control surface emissions and subsurface migration of landfill gas.
§60.759 (a)(3)(i)	Section 4-3.1	Page E-3, Section 5	Areas containing asbestos or other non-degradable materials may be excluded from coverage by the landfill gas collection and control system	No segregated, i.e. mono-fill, areas containing asbestos or non-degradable materials are know to exist at the site, therefore no areas of the landfill have been excluded from the coverage of the landfill gas collection and control system.
§60.759 (a)(3)(ii)	Section 4-3.1	Page E-3, Section 6	Areas considered to be non-productive (contributing less than 1 percent of the total non-methane organic compounds from the landfill) may be excluded from coverage of the landfill gas collection and control system.	No areas of the landfill are known to be non-productive at this time, therefore no areas of the landfill have been excluded from the coverage of the landfill gas collection and control system.

Regulatory Citation	*Report Reference*	*Appendix E Reference* [1]	*Regulatory Requirement*	*Implementation of Regulatory Requirement*
§60.759 (b)(1)	Section 4-4.1	Page E-5, Section 7	Landfill gas collection and control system components shall be constructed of PVC, HDPE or other non-porous corrosion resistant materials.	Landfill gas collection and control system components shall be constructed of PVC, HDPE or other non-porous corrosion resistant materials.
	Section 4-4.1	Page E-5, Section 8	Landfill gas collection and control system components shall have suitable dimensions to convey the maximum landfill gas flow rate and withstand future settlement, overburden and traffic loads.	Landfill gas collection and control system components were designed to accommodate the maximum landfill gas flow rate and withstand future settlement, overburden and traffic loads.
	Section 4-4.1	Page E-5, Section 9	Expansion of the landfill gas collection and control system will occur as needed to meet landfill gas emissions and migration standards.	Expansion of the landfill gas collection and control system will occur as needed to meet landfill gas emissions and migration standards.
	Section 4-4.1	Page E-5, Section 10	Extraction well perforations will control head loss and air infiltration throughout the system,	The landfill gas collection elements are perforated to minimize head loss and prevent excessive air infiltration into the system.
§60.759 (b)(2)	Section 4-4.2	Page E-5, Section 11	Extraction wells must not endanger the landfill base liner and must address the occurrence of water in the landfill.	The landfill gas extraction wells are designed and installed to extend from the landfill surface to approximately 75 percent of the waste thickness unless otherwise designed by an engineer, but no closer than 10 feet to the base liner. Liquids in the refuse are addressed by the leachate and condensate management systems.
	Section 4-4.2	Page E-6, Section 12	Suitable cross-section of the well holes and trenches is required for construction and completion of the collection elements.	The vertical boreholes and/or interim horizontal trenches will be constructed with sufficient cross section to allow for the proper construction of the collection elements.

Regulatory Citation	*Report Reference*	*Appendix E Reference* [1]	*Regulatory Requirement*	*Implementation of Regulatory Requirement*
§60.759 (b)(2)	Section 4-4.2	Page E-6, Section 13	Landfill gas collection and control system components must be designed to control air intrusion, prevent landfill gas from escaping the collection system, and prohibit refuse from entering the collection system.	Control of air intrusion and the escape of landfill gas from the system will be accomplished through the monitoring of the landfill gas collection and control system, operating the system under vacuum and continued maintenance of the landfill cover. The refuse is prohibited from entering the collection devices by gravel backfill or other approved materials placed in the hole or trench separating the refuse from the landfill gas collection elements.
	Section 4-4.2	Page E-6, Section 14	Gravel backfill in the extraction wells and trenches shall not obstruct pipe perforations.	Backfill of sufficient size will be used to prohibit entry or blockage of the collector perforations.
§60.759 (b)(3)	Section 4-4.3	Page E-6, Section 15	Collection device connections may be above or below ground, must include a positive closing throttling valve, necessary seals, access couplings, and at least one monitoring point.	The collection devices are connected to the collection header pipe and include a positive closing throttling valve, necessary seals, access couplings, and a minimum of one monitoring point.
§60.759 (c)	Section 4-5	Page E-6, Section 16	The collection header pipes must be adequate to handle the maximum landfill gas flow rate.	The collection header pipes are sized to adequately handle the maximum landfill gas flow rate.
§60.752 (b)(2)(ii)(A)(*2*)	Section 4-6.4	Page E-2, Section 2	Landfill gas collection shall occur in active cells with waste in place for five years or more; in closed cells with waste at final grade for two years or more.	The landfill gas collection and control system components will be installed per NSPS schedule requirements.
§60.752 (b)(2)(ii)(A)(*3*)	Section 4-6.4	Page E-2, Section 3	Landfill gas extraction wells shall apply a negative gage pressure to maintain a sufficient extraction rate of landfill gas without causing air infiltration.	A negative gage pressure is applied to the landfill gas collection elements via centrifugal blowers. The landfill gas collection system wellheads will be monitored for static pressure and indications of air infiltration.
§60.752 (b)(2)(ii)(A)(*4*)	Section 4-6.4	Page E-2, Section 4	Subsurface migration of landfill gas will be controlled.	The landfill gas collection and control system shall control subsurface migration and be verified by the monitoring of perimeter monitoring stations installed at the site.

TABLE 2 - LANDFILL GAS COLLECTION AND CONTROL SYSTEM (GCCS) DESIGN REVIEW CHECKLIST

Landfill Site Name: Winnebago Landfill
Location of Landfill: Rockford, Illinois
Landfill Owner: Winnebago Reclamation Services, Inc.
Date of Submittal: September 2009

Goals for the GCCS: (control migration) (control emissions) (safety)

(circle all that apply, add more as appropriate)

Is the GCCS proposed to be (active) or passive? (circle one)

The existing and proposed GCCS is active in nature and should serve to mitigate the potential for both subsurface and airborne migration, as well as the potential for accumulation in occupied structures.

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1. Was the design certified by a PE? **60752(b)(2)(i)** (Yes) No
(circle one)

   Angela M. Krueger is a Registered Professional Engineer in Illinois and has certified this Design Plan as the design engineer. Please reference Section 1 of the Design Plan.

2. Was the design submitted within 12 months of the ~~first~~ report of the site exceeding 50 Mg/yr. of NMOC's? **60.752(b)(2)(i)** (Yes) No
(circle one)

   If no, describe circumstances: *On behalf of Winnebago Reclamation Services, Inc., Cornerstone Environmental Group, LLC has prepared this landfill gas collection and control system (GCCS) Design Plan for the Northern Expansion Area.*

3. Is the GCCS planned to be operational within 30 months of the first report of the site exceeding 50 MG/yr. of NMOC's? **60.752(b)(2)(ii)** Yes (No)
(circle one)

If no, describe circumstances: *At the time of this report, an active GCCS has been constructed and is operating at the Winnebago Landfill.*

4. Does the GCCS comply with the 2 year/5 year rule? **60.752(b)(2)(ii)(A)(2)**
(Yes) No
(circle one)

If no, describe circumstances:
Please Reference Section 4.6.4 of the Design Plan.

5. What is the design life of the GCCS? **60.752(b)(2)(v)** _____
(If less than 15 years describe why) *The design life of the GCCS includes both the operational period of the facility and the post-closure period while landfill gas (LFG) is still being generated in quantities that require environmental control. Individual components of the GCCS will be replaced or repaired as age and usage reduce their efficiency.*

6. Is the GCCS design for the maximum expected flow rates during its design life?
60.752(b)(2)(ii)(A)(1) (Yes) No
(circle one)

If no, describe circumstances:
Please reference Section 4.5 of the Design Plan.

7. Describe the measures taken to control lateral LFG migration in the design. If no measures were taken, describe why? **60.752(b)(2)(ii)(A)(4)** *The design of the GCCS uses active extraction to mitigate the potential for lateral LFG migration. This process is enhanced by the presence of a flexible membrane liner (FML) base liner system. Please reference Section 4.1 of the Design Plan.*

8. If a passive system is planned, are the necessary liners in place?
60.752(b)(2)(ii)(B)(2) Yes No
(circle one)
If no, describe circumstances:
Not Applicable – an active system is existing and proposed.

9. Is adequate density of collectors planned? Refer to Section 5.1 (Yes) No
(circle one)

If no, describe circumstances: _____

Please reference Section 4.2 of the Design Plan.

10. Is the LFG Conveyance System sized properly? Refer to Section 5.2

(Yes) No
(circle one)

The LFG conveyance system is adequately sized to handle the current LFG generation rate as determined using the United States Environmental Protection Agency (USEPA) LandGEM V3.02 and is expandable. The LFG conveyance system will be expanded to handle future LFG generation rates in accordance with the New Source Performance Standards (NSPS) to mitigate surface and lateral LFG migration. Please reference Sections 4.4.1.2 and 4.6.5 the Design Plan.

11. Is the LFG planned to be routed to a control device? **60.752(b)(2)(iii)**

(Yes) No
(circle one)

Please reference Section 4.6.5 of the Design Plan.

12. Describe the control device (circle one) (utility flare) enclosed flare (other)

The control device is an existing landfill gas-to-energy facility sized for 1,936 standard cubic feet per minute (scfm) and utility flares sized for 3,290 scfm total. The flares will be operated in accordance with §60.18. Please reference Section 4.6.5 of the Design Plan.

13. If the control device is a flare, does it include continuous temperature monitoring and a flow measurement device? **60.756(b) and (c)** (Yes) No
(circle one)

If no, describe circumstances: _____

14. Is the flare sized properly? Refer to section 5.3 of the student manual.

(Yes) No
(circle one)

The flares are sized for a total gas generation potential of 3,290 scfm, greater than the design flow rate in accordance with §60.752(b)(2)(iii)(B). Please reference Section 4.6.5 of the Design Plan.

15. If a control device other than a flare is planned, describe the estimated hours and duration it will be down for maintenance per year:

The LFGTE plant will have a regular maintenance schedule.

16. Operational Issues **60.753(b), (c), (d), (e), (f)**
Will the GCCS be operated with a vacuum at every well? (Yes) No

The GCCS will be operated with a vacuum at each extraction point, with the exception of mitigating circumstances under §60.753(b)(1).

17. Will the GCCS be operated at the appropriate gas temps? (Yes) No

The GCCS is intended to operate at LFG temperatures below 55°C (131°F).

18. Will the GCCS be operated with minimal amounts of air? (Yes) No

The GCCS is designed to prevent excessive air infiltration. Please reference Section 4.1.10 of the Design Plan.

19. ~~Will~~ monitoring be done monthly to confirm these operational issues?
(Yes) No

Monitoring will be conducted in accordance with NSPS requirements. Please reference Section 4.2 of the Design Plan.

20. Will surface emissions monitoring be completed? (Yes) No

Monitoring will be conducted in accordance with NSPS requirements. Please reference Section 4.2 of the Design Plan.

21. ~~Will~~ the blower automatically be shutdown if the control device is inoperable?
(Yes) No

The blower system will automatically be shut down if the control device becomes inoperable. Please reference Section 4.6.5 of the Design Plan.

22. Does the GCCS include fittings to allow connection of additional ~~collectors~~ if necessary in the future? **60.756(2)** (Yes) No
(circle one)

If no, describe circumstances: *The header system will incorporate blind flanges along the transmission piping to facilitate expansion of the system. Additionally, high density polyethylene (HDPE) piping can be readily modified to accept tees or other fittings necessary for system expansion.*

Does the wellhead for all collectors include at least one sample port and one thermometer port? 60.756(2) Yes No

(circle) one)

If no, describe circumstances: *The wellheads for all collectors will include at least one sample port and one thermometer port. Please reference Section 4.6.4 and Appendix C of the Design Plan.*

1 INTRODUCTION AND CERTIFICATION

1.1 Purpose

The purpose of this document is to provide a design plan in accordance with the New Source Performance Standards (NSPS) design requirements for the landfill gas (LFG) collection and control system (GCCS) at the Winnebago Landfill Facility. The Illinois Environmental Protection Agency (IEPA) ID Numbers are for Land 2018080001 and Air 201801AAF. This document serves as the GCCS Design Plan and was prepared pursuant to 40 Code of Federal Regulations (CFR) Part 60, Subpart WWW, and NSPS for Municipal Solid Waste Landfills and 35 Ill Administration Code 811.311 and 811.312.

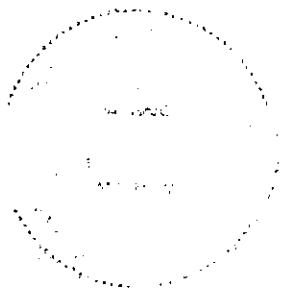
1.2 Compliance Summary Table

A summary of the pertinent NSPS regulations and implementation of these regulations at the Winnebago Landfill is presented in Table 1 of this Design Plan. Additionally, location references of the regulations in this Design Plan and in Appendix E of the NSPS enabling document are presented.

1.3 Certification

This NSPS Design Plan for the GCCS at the Winnebago Landfill has been prepared by Cornerstone Environmental Group, LLC (Cornerstone), as authorized by Winnebago Landfill Company, LLC and Winnebago Reclamation Services, Inc. which respectively own and operate the Municipal Solid Waste (MSW) Landfill. I certify that the GCCS as described in this plan meets the design requirements specified in 40 CFR §60.759 and any alternatives pursuant to 40 CFR §60.752(b)(2). I further certify that this Design Plan was prepared by me or under my direct supervision, and that I am a duly registered Professional Engineer.

Angela M. Krueger, P.E.
IL P.E. No. 062-058348



2 EXISTING SITE CONDITIONS

2.1 Landfill Description

The Winnebago Landfill Facility is located in Rockford, Illinois. The Winnebago Landfill Facility is owned by Winnebago Landfill Company, LLC and operated by Winnebago Reclamation Services, Inc.

The Winnebago Landfill Facility consists of multiple waste disposal units . They are the North Expansion unit, the North unit and the South unit. The North and South units have existing GCCS in place. The purpose of this document is to establish the GCCS design plan for the Northern Expansion and document the emission increase associated with the construction of the North Expansion unit.

The Northern Expansion has a total permitted landfill area of 66.6 acres, which is the permitted disposal area. Waste placement, which began in 2008, is expected to continue through 2020, given current rate of waste acceptance. The Northern Expansion has a waste capacity of approximately 9.28 million megagrams (Mg) (10.2 million tons). The Northern Expansion is underlain with a Subtitle D liner system with a flexible membrane liner (FML). The final cover system will consist of a composite geosynthetic/low permeability soil barrier.

2.2 Landfill Gas Collection and Control System

Winnebago Landfill currently has an active GCCS installed and operating as required by NSPS in the North and South Units. Waste placement activities began in the Northern Expansion in 2008, and it is anticipated to reach capacity in 2020 at current filling rates. The GCCS design presented in this document pertains to the Northern Expansion, as it will continue waste placement activities, and will expand the existing GCCS as required by NSPS.

This section identifies proposed components for the GCCS at the Winnebago Landfill. The proposed design consists of vertical wells and interim/supplemental horizontal trenches, if warranted, to extract LFG from the disposal areas.

The proposed vertical extraction wells will have a well spacing ranging from 200 to 250 feet throughout the waste fill areas. Interim/supplemental horizontal collection trenches may also be utilized in areas that will not reach final grade within five years of initial waste deposition. Interim/supplemental horizontal collection trenches allow extraction of LFG from areas that are not easily accessible to vertical wells. Interim/supplemental horizontal collectors may be utilized in waste less than five years old to collect LFG once a sufficient barrier of waste (approximately 15 feet) is placed above the collector to reduce the potential for air infiltration. If utilized, trenches will be spaced at a frequency of approximately 150 to 300 feet horizontally and approximately 20 to 60 feet vertically.

Although no sections of the disposal area have been designated for the construction of horizontal LFG collection trenches, Winnebago Reclamation Services, Inc. reserves the right to install additional components should future operational concerns dictate the need in other areas of the landfill.

Permanent lateral and header pipes are installed generally below ground surface and typically constructed of high density polyethylene (HDPE) pipe. Temporary piping may be installed either above or below ground surface. Currently LFG is conveyed through this pipe network to a landfill gas-to-energy (LFGTE) facility and utility flares. Condensate that is formed in the Northern Expansion will be collected in barometric traps in the collection piping and condensate pump stations. The condensate will drain from these traps to the facility's Leachate Collection System (LCS) via direct connections to the LCS cleanout/access risers. The condensate will be disposed of coincidentally with landfill leachate in accordance with the requirements of the facility solid waste permit.

Additional information and drawings of the GCCS are included in Appendix C.

3 FUTURE SITE DEVELOPMENT

3.1 Landfill Development Plan

Winnebago Reclamation Services, Inc. will continue waste filling operations at the Northern Expansion in accordance with the solid waste permit. Installation of additional GCCS components is anticipated to be coordinated with fill development and as otherwise required by NSPS' regulations regarding installation of GCCS components stipulated in §60.752(b)(2)(ii)(A)(2). Due to operational changes, the GCCS design presented in Appendix C may be altered to maintain compliance with the provisions of the NSPS and to accommodate actual field conditions at the time of construction.

3.2 Landfill Gas Control System Expansion Capabilities

The GCCS will be designed to be readily expanded as fill operations proceed. Vertical wells will typically be installed in areas that have reached final grade. Vertical wells and/or interim/supplemental horizontal collection trenches will be installed as an interim control measure in disposal areas that that are not yet at final refuse grades.

Vertical extraction wells installed prior to reaching final grade will either be extended to the final grade level or abandoned and replaced. This determination will be made based upon the physical condition of the wells, their ability to provide effective LFG extraction, and field conditions at the time of final cap installation.

LFG headers will be sized to accommodate the maximum expected flow, and be fitted with flanged tees for expansion as new collectors are installed, in accordance with NSPS requirements. Additionally, the use of HDPE header piping provides for flexible and efficient connections for future expansion of the header piping system.

In the event that actual LFG flows exceed the capacity of the LFG control device, additional control device capacity will be added to handle the LFG flows. The LFG treatment area was designed to allow for the addition of additional LFG control device capacity as warranted.

4 COMPLIANCE REVIEW AND EVALUATION

4.1 Compliance with §60.759(a)(1)

> §60.759(a)(1) The collection devices within the interior and along the perimeter areas shall be certified to achieve comprehensive control of surface gas emissions by a professional engineer. The following issues shall be addressed in the design: depths of refuse, refuse gas generation rates and flow characteristics, cover properties, gas system expandability, leachate and condensate management, accessibility, compatibility with filling operations, integration with closure end use, air intrusion control, corrosion resistance, fill settlement, and resistance to the refuse decomposition heat.

The GCCS has been designed to be consistent with NSPS requirements to achieve comprehensive control of both lateral migration and surface emissions of LFG.

Issues related to compliance with §60.759(a)(1) are discussed in the following sections.

Applicable information used in the design of the GCCS is included in Appendix A (A-1: Gas Generation Rate Modeling, A-2: Radius of Influence and Well Spacing Calculations, A-3: Condensate Generation Estimates, and A-4: Positive Pressure Allowances), Appendix B (Head Loss Analysis), Appendix C (GCCS Design Plans), and Appendix D (Surface Emissions Monitoring Plan).

4.1.1 Control of Surface Emissions

The GCCS is designed to minimize both subsurface lateral migration and surface emissions of LFG from the Winnebago Northern Expansion Landfill. System performance depends upon the installation of a satisfactory GCCS system, its proper management, and maintenance of a suitable final refuse cover system. If there is a temporary exceedance in emissions it will be addressed by appropriate response, evaluating both the GCCS and final cover systems. Appropriate action will then be taken to correct the exceedance, as required by NSPS.

4.1.2 Depths of Refuse

Depths of refuse were calculated, at the time of the design of the GCCS, based upon existing topography, final development permit plan, and record documentation of landfill liner grades. The landfill surface elevation was determined from aerial survey data at the time of design.

4.1.3 Landfill Gas Generation Rates and Flow Characteristics

In compliance with §60.752(b)(2)(ii)(A), the maximum expected LFG flow rate for the Northern Expansion was used for sizing the GCCS. The LFG generation rate calculations were performed using the United States Environmental Protection Agency (USEPA) Landfill Gas Emission Model (LandGEM) (AP-42 default values of k=0.04/year and L_0=100 m^3/Mg), historical waste receipts and the permitted design capacity of the facility.

The maximum LFG generation rate for the Northern Expansion was calculated to be approximately 3,947 scfm in 2021. The current LFG generation estimate for 2009 is 119 scfm.

The proposed GCCS components to be installed in the Northern Expansion shall be sized to accommodate a LFG flow rate of 3,947 scfm. As discussed in Section 3.2 of this Design Plan, the GCCS will be installed in a manner to allow expansion of the wellfield, piping, and LFG control device capacity as actual LFG flows increase as landfilling continues at the site.

The LandGEM emissions model is a "design tool," which uses the information available to project future operating conditions. This model was developed based upon operating conditions at a cross-section of landfills within the United States, and is approved for use by the USEPA. Actual operating parameters may dictate changes in the system flow characteristics and process equipment as the system is developed. These changes will be made in accordance with §60.752.

Landfill gas generation projections are provided in Appendix A.

4.1.4 Landfill Cover Properties

The proposed final landfill cover at the Northern Expansion will incorporate a composite geosynthetic/low permeability soil barrier. The primary purpose of the final cover system unit is to preclude precipitation infiltration that would generate additional leachate. However, the final cover system design also provides a significant barrier to LFG

emission and air infiltration when combined with an active LFG extraction system. The GCCS will provide components for collecting LFG or relieving pressures from LFG from beneath the landfill covers.

4.1.5 Landfill Gas Control System Expandability

Expandability of the GCCS is achieved by installing tees with blind flanges along the transmission piping or providing expansion capabilities for additional LFG control devices. These flanges or expansion points provide planned access for expansion of the LFG transmission piping and LFG control device facility in the future. In the event that actual LFG flow rates do exceed the capacity of the system, additional GCCS components will be designed and installed in accordance with IEPA requirements.

4.1.6 Leachate and Condensate Management

Leachate management at the Northern Expansion Landfill is accomplished through the use of an engineered leachate collection and management system (LCS). Leachate is pumped from the LCS for off-site treatment and disposal. The LCS is designed according to Subtitle D standards (40 CFR§257 and §258) and is part of the Solid Waste Disposal Permit.

LFG piping grades will be maximized where practical to reduce the impact of differential settlement and promote positive condensate drainage. Proposed transmission header and lateral piping will be sloped at a minimum of 3 percent within waste limits (0.5 percent outside waste limits), unless otherwise denoted, to promote condensate to flow by gravity to engineered low points in the GCCS piping, for collection of the condensate. Condensate collected at the engineered low points will be handled by pump stations or engineered gravity drains that will discharge directly into the LCS. Areas outside the Subtitle D liner system will collect condensate in pump stations, for periodic discharge to the LCS within the Subtitle D area via a force main(s).

4.1.7 Accessibility

Accessibility to the GCCS components is achieved by installing commonly accessed components (such as wellheads and monitoring ports) on relatively flat surfaces of the landfill or near the landfill's road network. Wellheads, piping risers, valves and monitoring ports will be installed above grade, or within vaults, to maintain accessibility.

4.1.8 Compatibility with Refuse Filling Operations

At the time of this report, an active GCCS has been constructed and is operating at the Winnebago Landfill Facility. However, the Northern Expansion unit currently has no GCCS constructed. Future additions or expansions of the GCCS will be designed to integrate the existing GCCS components currently operating at the Winnebago Landfill Facility.

As refuse filling operations proceed and portions of the site reach final or near-final grades, GCCS components will be installed. This method of installation allows GCCS components to be constructed in accordance with §60.752(b)(2)(ii)(A)(*2*)(*i*) and (*ii*) while minimizing interference of the GCCS with ongoing filling operations, and daily landfill activities.

4.1.9 Integration with Closure End Use

Currently, the post-closure end-use for the site is unspecified and will likely be utilized as open space. Any modifications to the closure end-use must be approved by Winnebago Reclamation Services, Inc. personnel to evaluate their compatibility with the GCCS. Any items of concern related to maintaining and operating the GCCS will be mitigated by either altering the proposed post-closure end-use or by adjusting or modifying the GCCS in accordance with NSPS requirements.

4.1.10 Air Intrusion Control

The LFG collection elements are designed to prevent excessive air infiltration through the use of solid pipe and solid backfill near the ground surface for vertical LFG extraction wells and interim/supplemental horizontal trenches in the perimeter slope area. Hydrated bentonite plugs and geomembrane seals, if warranted, will be provided around vertical well casings and interim/supplemental horizontal trench access piping, where they penetrate the landfill final cover or interim cover systems. Further, air intrusion control will be accomplished through monitoring of the operational monitoring standards for the LFG collection elements.

4.1.11 Corrosion Resistance

Corrosion resistance of the GCCS is achieved through the use of corrosion resistant materials or materials that have a corrosion resistant coating, in accordance with 40 CFR§60.759(b)(1). . The primary components used in the construction of the GCCS are high density polyethylene HDPE and polyvinyl chloride (PVC) piping. All HDPE piping will have a minimum rating standard dimension ratio (SDR) of 17. All PVC piping will

have a minimum rating of Schedule 40. Components will be inspected during routine GCCS monitoring for abrasion, chipping, or other potential deterioration of the components. If damage to the materials is observed that may be detrimental to the performance of the GCCS, the components will be replaced or repaired.

4.1.12 Fill Settlement

Settlement will occur due to decomposition of the refuse. To accommodate refuse settlement, the GCCS components will be designed and installed with several features to account for this settlement, including:

- LFG extraction wellheads connected to the LFG transmission piping via a flexible pipe or hose connection. This allows the LFG piping to accommodate changes in the orientation of the LFG transmission piping or LFG extraction well.

- LFG transmission piping sloped at sufficient grades (a minimum 3.0 percent within the waste limits, and 0.5 percent outside the waste limits, see Section 4.1.6) so that reasonable amounts of differential and total settlement may occur without causing pipe breakage, or disrupting the overall flow gradient of the LFG transmission piping.

- HDPE piping used for the construction of the header piping and transmission system. HDPE piping is flexible and absorbs differential settlement without breaking or cracking.

4.1.13 Resistance to Decomposition Heat

Resistance of the GCCS to the heat generated as a result of refuse decomposition was achieved through the use of materials tested and proven to withstand temperatures well above those typically found in landfills. The GCCS will be inspected during routine LFG system monitoring for heat damage. If heat damage of the GCCS components is observed and is believed to be detrimental to the operation of the GCCS, the cause of the elevated landfill temperature will be investigated and the GCCS will be adjusted or modified to mitigate the effects of the elevated temperatures.

4.2 Compliance with §60.759(a)(2)

> **§60.759(a)(2)** The sufficient density of gas collection devices determined in paragraph (a)(1) of this section shall address landfill gas migration issues and augmentation of the collection system through the use of active or passive systems at the landfill perimeter or exterior.

Per the definition stated in §60.751, "sufficient density" means "any number, spacing, and combination of collection system components. . . necessary to maintain emission and migration control as determined by measures of performance set forth in this part." Well spacing at the Winnebago Landfill was established using the method described in the book "Methane Generation and Recovery from Landfills, EMCON, 1982." The values developed by this method were compared to those developed by the equation from the *NSPS Background Information Document, 1991* with a more conservative EMCON value utilized for design purposes. This is consistent with spacing criteria used at other landfills and should effectively control surface emissions and subsurface migration of LFG in accordance with NSPS requirements.

Additionally, the spacing of vertical and interim/supplemental horizontal extraction wells is within the guidelines defined in *Table 5-1, Summary of Suggested Collector Density, Training Course for Landfill Gas NSPS/EG Regulatory Personnel to Review GCCS Design Submittals, North Carolina State University, September, 1998.* This guidance recommends a horizontal collector spacing of 30 feet to 50 feet vertically and 150 feet to 300 feet horizontally for interim horizontal extraction wells, and a vertical well spacing of 250 feet to 300 feet in post-Subtitle D landfills with wet waste.

The proposed vertical well spacing shall be 200 feet for perimeter wells and 250 feet for interior wells. Refer to Appendix A for well radius of influence and well spacing calculations.

Winnebago Reclamation Services, Inc. currently conducts, at a minimum, quarterly surface emissions monitoring at the Winnebago Landfill Facility in accordance with NSPS requirements. Winnebago Reclamation Services, Inc. will continue to conduct surface monitoring in accordance with NSPS requirements. If the GCCS at the Winnebago Landfill Facility does not meet the measures of performance set forth in the NSPS, the GCCS will be adjusted or modified in accordance with the NSPS requirements. These adjustments or modifications may include the installation of additional collection elements, cap repairs or other actions defined by field conditions at the time of monitoring.

4.3 Compliance with §60.759(a)(3)

> **§60.759(a)(3)** The placement of gas collection devices determined in paragraph (a)(1) of this section shall control all gas producing areas, except as provided by paragraphs (a)(3)(i) and (a)(3)(ii) of this section.

Issues related to compliance with §60.759(a)(3) are discussed in the following sections.

4.3.1 Asbestos and Non-degradable Materials

> §60.759(a)(3)(i) Any segregated area of asbestos or non-degradable material may be excluded from collection if documented as provided under §60.758(d). The documentation shall provide the nature, date of deposition, location and amount of asbestos or non-degradable material deposited in the area, and shall be provided to the Administrator upon request.

At the time of the design of the GCCS, no areas have been excluded from the coverage of the GCCS as a result of the placement of asbestos, or other non-degradable materials.

4.3.2 Nonproductive Areas

> §60.759(a)(3)(ii) Any nonproductive area of the landfill may be excluded from control, provided that the total of all excluded areas can be shown to contribute less than 1 percent of the total amount of NMOC emissions from the landfill. The amount, location, and age of the material shall be documented and provided to the Administrator upon request. A separate NMOC emissions estimate shall be made for each section proposed for exclusion, and the sum of all such sections shall be compared to the NMOC emissions estimate for the entire landfill.

At the time of the design of the GCCS, no areas of the landfill were determined to be non-productive; therefore no areas of the landfill have been excluded from the coverage of the GCCS.

4.4 Compliance with §60.759(b)(1), (2), and (3)

> §60.759(b) Each owner or operator seeking to comply with §60.752(b)(2)(i)(A) shall construct the gas collection devices using the following equipment or procedures:

4.4.1 Landfill Gas Extraction Component Construction

> §60.759(b)(1) The landfill gas extraction components shall be constructed of polyvinyl chloride (PVC), high density polyethylene (HDPE) pipe, fiberglass, stainless steel, or other non-porous corrosion resistant material of suitable dimensions to: convey projected amounts of gases; withstand installation, static, and settlement forces; and withstand planned overburden or traffic loads. The collection system shall extend as necessary to comply with emission and migration standards. Collection devices such as wells and horizontal collectors shall be perforated to allow gas entry without head loss sufficient to impair performance across the intended extent of control. Perforations shall be situated with regard to the need to prevent excessive air infiltration.

Issues related to compliance with §60.759(b)(1) are discussed in the following sections.

4.4.1.1 Materials

The GCCS components will be constructed of PVC, HDPE, fiberglass, corrosion-resistant steel, Neoprene (gaskets and seals) and other non-porous corrosion resistant materials.

4.4.1.2 Component Sizing

The GCCS components proposed to be installed in the Northern Expansion are sized for a maximum LFG flow rate of 3,947 scfm. Capacity of the GCCS components will be phased in as LFG generation and extraction rates increase.

The site has a landfill gas-to-energy facility as well as a utility flare on site for the destruction of LFG. The LFGTE facility is rated for 1,936 standard cubic feet per minute (scfm). The two utility flares are rated 790 and 2,500 scfm. The total nominal LFG that can be treated is 5,226 scfm. When LFG flow rates exceed the capacity of the control device, additional control device capacity shall be installed in accordance with NSPS requirements.

4.4.1.3 Component Loading

The GCCS components are designed to withstand the estimated installation, static, settlement, overburden, and traffic loads. Installation loads were determined to be insignificant for GCCS components based on the installation methods used. Static loads from the vacuums applied to the GCCS components and applied loads on the GCCS were both evaluated. Vacuum loads required for the GCCS operation were compared to, and found to be less than, the allowable vacuum loads for the GCCS components. Foundations used for GCCS components are designed to handle the applied loads. The applied loads on GCCS components within the landfill, as well as settlement forces, cannot accurately be predicted due to the non-homogeneous nature of the refuse within the landfill.

The GCCS components within the landfill will be consistent with those at other landfills that have been in place for extended periods of time (in excess of 15 years) and verified to withstand applied static and settlement forces. Overburden and traffic loads for the LFG transmission piping are less than the allowable loads recommended by the piping manufacturer.

4.4.1.4 System Expansion

The GCCS shall be expanded as necessary to comply with NSPS requirements. Winnebago Reclamation Services, Inc. will conduct monitoring and document compliance of the GCCS at the Northern Expansion, in accordance with NSPS requirements. If the GCCS at the Northern Expansion does not meet the measures of performance set forth in the NSPS, the GCCS will be adjusted or modified in accordance with NSPS requirements.

4.4.1.5 Component Perforation

The vertical well and interim/supplemental horizontal trench collector elements will be perforated as shown on the design plans (Appendix C), to allow LFG entry without inducing head losses sufficient to impair performance across the intended extent of control. The perforation patterns used for the Northern Expansion GCCS design have been successfully used in previous LFG control applications.

4.4.2 Landfill Gas Extraction Component Installation

> **§60.759(b)(2)** Vertical wells shall be placed so as not to endanger underlying liners and shall address the occurrence of water within the landfill. Holes and trenches constructed for piped wells and horizontal collectors shall be of sufficient cross-section so as to allow for their proper construction and completion including, for example, centering of pipes and placement of gravel backfill. Collection devices shall be designed so as not to allow indirect short circuiting of air into the cover or refuse into the collection system or gas into the air. Any gravel used around pipe perforations should be of a dimension so as not to penetrate or block perforations.

Issues related to compliance with §60.759(b)(2) are discussed in the following sections.

4.4.2.1 Component Placement

Depths of refuse were calculated, at the time of the design of the GCCS, based upon existing topography, final development permit plan and record documentation of landfill liner grades. The landfill surface elevations are determined from aerial survey data at the time of design. Vertical LFG extraction wells are designed to extend from the landfill surface to no more than 10 feet from the landfill base, or to approximately seventy-five percent of the refuse depth, unless otherwise designed for specific site considerations.

4.4.2.2 Leachate

The occurrence of leachate within the landfill will be addressed by the LCS as stated in Section 4.1.6 of this Design Plan. Leachate management within the landfill will be accomplished through the LCS which includes a leachate drainage layer, perforated

collection piping, side slope risers with liquid pumping equipment, and liquid storage and disposal systems.

For these reasons, it is not expected that free liquids will be encountered during the drilling of wells for the vertical LFG extraction wells. If free liquids are encountered, the drilling contractor will attempt to drill through the perched zone of liquids allowing drainage into the underlying waste mass and the LCS. In the event that the zone of perched liquids cannot be penetrated, the well installation may be terminated. If necessary, appropriate measures will be taken to complete the well installation procedure at a nearby location.

If perched liquids are observed within the extraction wells after installation, and it is determined that the liquid level is restrictive to efficient LFG extraction, the leachate level will be reduced. This is typically accomplished by periodic pumping of the liquids using either electric or pneumatic pumping systems. Liquids removed from the well casings will be discharged to the LCS.

4.4.2.3 Wells and Trenches

Vertical wells and interim/supplemental horizontal trenches, constructed for LFG collection elements, will be of sufficient cross-section to allow for their proper construction and completion, including centering of the pipes and placement of gravel backfill. The wells and interim trenches will be constructed under supervision of a construction quality assurance program implemented by Winnebago Reclamation Services, Inc. and verified to be properly constructed, as indicated on the design plans in Appendix C.

Record documentation of the well and interim trench installations will be maintained at the Winnebago Landfill offices.

4.4.2.4 Component Short Circuiting

LFG collection elements are designed to prevent air infiltration through the cover, refuse contamination of the collection elements, and direct venting of LFG to the atmosphere. Air intrusion control will be verified through monitoring of LFG quality at the extraction components, monitoring of surface emission levels and maintenance of the landfill cover in accordance with NSPS requirements. Separation of the collection elements from the refuse is accomplished by placing gravel backfill in the annular borehole space around extraction wells casings and the interim/supplemental horizontal trench pipes, providing a filter pack between the refuse and the LFG collection elements. Direct venting of the LFG to the atmosphere is avoided by operating the GCCS under a controlled application of vacuum and the quarterly monitoring of surface emissions (see Section 4.2).

4.4.2.5 Gravel Backfill

Gravel of sufficient size is specified to prevent penetration or blockages of the LFG collector pipe perforations. Gravel (non-calcareous) to be utilized will be a nominal 1 to 3-inch in size.

4.4.3 Landfill Gas Extraction Component Connections to LFG Transmission Piping

> **§60.759(b)(3)** Collection devices may be connected to the collection header pipes below or above the landfill surface. The connector assembly shall include a positive closing throttle valve, any necessary seals and couplings, access couplings and at least one sampling port. The collection devices shall be constructed of PVC, HDPE, fiberglass, stainless steel, or other non-porous material of suitable thickness.

The collection devices are connected to the collection header pipes using lateral piping. The lateral piping will be connected to the header piping either above or below the landfill surface, as required by field conditions at the time of installation. The connector assemblies (vertical extraction wellheads) will be located above grade. These assemblies include a positive closing throttle valve, necessary seals and couplings, access ports and couplings, and a minimum of two sampling ports. The collection devices will be constructed of PVC, HDPE, fiberglass, corrosion-resistant steel, and other non-porous materials of suitable thickness. The GCCS components are designed to withstand anticipated installation, static, settlement, overburden, and traffic loads.

4.5 Compliance with §60.759(c)(1) or (2)

> **§60.759(c)** Each owner or operator seeking to comply with §60.752(b)(2)(i)(A) shall convey the landfill gas to a control system in compliance with §60.752(b)(2)(iii) through the collection header pipe(s). The gas mover equipment shall be sized to handle the maximum gas generation flow rate expected over the intended use period of the gas moving equipment using the following procedures:

Issues related to compliance with §60.759(c) are discussed in the following sections.

4.5.1 Existing Landfill Gas Flow Rate Data

> **§60.759(c)(1)** For existing collection systems, the flow data shall be used to project the maximum flow rate. If no flow data exists, the procedures in paragraph (c)(2) of this section shall be used.

At the time of this report, an active GCCS has been constructed and is operating at the North and South Units of the Winnebago Landfill. Current operating data indicates a

LFG extraction rate of approximately 1,402 scfm (normalized to 50 percent methane). The Northern Expansion does not have an active system installed at the time of this report.

The 2009 LandGEM estimates a generation rate of approximately 2,028 scfm for closed area. The 2009 LandGEM estimates a generation rate of approximately 513 scfm for the North Expansion. Assuming 100% coverage, and an extraction efficiency of 90%, the anticipated LFG collection rate for the landfill is approximately 2,290 scfm.

This is an acceptable LFG extraction rate considering the percentage of waste covered by an active GCCS, which affects the extraction efficiency, and compares well to real-time operating data.

Please refer to Appendix A for a detailed evaluation of the LFG generation and recovery potential.

4.5.2 Future Landfill Gas Flow Rate Estimates

> **§60.759(c)(2)** For new collection systems, the maximum flow rate shall be in accordance with §60.755(a)(1).

The GCCS is an existing system and therefore future LFG flow rates for GCCS additions or expansion will be in accordance with §60.759(c)(1). The Northern Expansion has an estimated Landfill Gas Flow Rate of 3497 in the year 2021.

4.6 Alternatives and Compliance with §60.752(b)(2)

> **§60.752(b)(2)** If the calculated NMOC emission rate is equal to or greater than 50 megagrams per year, the owner or operator shall:

Based on the NSPS method for estimating the potential maximum non-methane organic compound (NMOC) emission rate, the Winnebago Landfill has exceeded the 50 megagrams per year (Mg/yr) threshold and is therefore required to comply with section §60.752(b)(2) of the NSPS.

4.6.1 Submit a Design Plan

> **§60.752(b)(2)(i)** Submit a collection and control system design plan prepared by a professional engineer to the Administrator within 1 year:

On behalf of Winnebago Reclamation Services, Inc., Cornerstone has prepared this GCCS Design Plan to update and replace existing GCCS Design Plans. Winnebago

Reclamation Services, Inc. is submitting this Design Plan to the Illinois Environmental Protection Agency (IEPA), with a copy sent to the USEPA Region 5 office for approval, consistent with NSPS requirements.

4.6.2 Alternatives to the NSPS

> **§60.752(b)(2)(i)(B)** The collection and control system design plan shall include any alternatives to the operational standards, test methods, procedures, compliance measures, monitoring, record keeping or reporting provisions of §60.753 through §60.758 proposed by the owner or operator.

The following alternatives to the operational standards, test methods, procedures, compliance measures, monitoring, record keeping or reporting provisions of §60.753 through §60.758 of the NSPS are proposed at this time:

4.6.2.1 Surface Emissions Monitoring Pattern

> **§60.753(d):** "...A surface monitoring design plan shall be developed that includes a topographical map and the rationale for any site specific deviations from the 30 meter intervals. Areas with steep slopes or other dangerous areas may be excluded from surface testing.

Winnebago Reclamation Service, Inc. is proposing for the Winnebago Landfill to widen the spacing between intervals from 30 meters to 60 meters in areas that will have final cover in place in the future.

The facility also proposes to exclude dangerous areas such as roads, the active area, truck traffic areas, construction areas, areas with snow or ice cover, and slopes steeper than or equal to 3:1 from surface testing.

4.6.2.2 Surface Emissions Monitoring Correction Variance

> **§60.755(c)(4):** "Any reading of 500 ppm or more...shall be recorded as a monitored exceedance...cover maintenance or adjustments to the vacuum....shall be made and the location shall be remonitored within 10 calendar days after detecting the exceedance..."

Winnebago Reclamation Service, Inc. is proposing for the Winnebago Landfill that a variance to the 10 day window allotted for adjustments to the cover and/or collection system. Industry experience with NSPS facilities in the Northeast and Midwest suggests that this 10 day time frame is not reasonable to effect comprehensive repairs during all quarters of a typical year. For example, if the Winnebago Landfill experiences a precipitation event following a surface scan, it may take several days or even weeks for the side slopes of the landfill to dry out enough to support construction equipment for cover repairs. This is due to the nature of the final cover required at many landfills;

usually, it is several feet of clay overlain by six inches of topsoil. Clay can hold water for long periods of time. If the side slopes are not completely dry, the repair equipment can cause even greater damage to the cover (and subsequently higher emissions) than the original erosion or crack.

Poor weather conditions can prevent cover maintenance, leading the follow-up rescans 10 days later to automatically fail. This can ultimately force the installation of an unneeded extraction well, when all that was really required was enough time to affect a cover repair.

Winnebago Reclamation Service, Inc. is therefore requesting that the 10 day rescan time frame be extended by an additional two weeks, in the event of bad weather conditions after a quarterly surface scan (should it be determined that the cover was the cause of the failing reading). Winnebago Reclamation Service, Inc. is proposing to receive this two week extension automatically, upon providing written notification to the IEPA that the extra time is needed due to poor weather conditions. Winnebago Reclamation Service, Inc. will place the notification letter in the NSPS files, along with a summary of the poor weather conditions.

4.6.2.3 Positive Pressure

> §60.753(b)(2): "Operate the collection system with negative pressure at each wellhead except under the following conditions:
>
> (1) A fire or increased well temperature. The owner or operator shall record instances when positive pressure occurs in efforts to avoid a fire. These records shall be submitted with the annual reports as provided in 60.757(f)(1);.
>
> **(2) Use of a geomembrane liner or synthetic cover. The owner or operator shall develop acceptable limits in the design plan.**
>
> (3) A decommissioned well. A well may experience a static positive pressure after shut down to accommodate for declining flows. All design changes shall be approved by the Administrator.

Extraction wells located in portions of the disposal area which posses are overlain by a geomembrane or synthetic cover, i.e. the closed portions of the Landfill, may be operated under positive pressure, in accordance with §60.753(b)(2). This variance requires the demonstration of acceptable pressure limits within the Design Plan.

Calculations of the allowable positive pressure within an extraction point located in an area overlain by a geomembrane or synthetic cover are provided in Appendix A. These calculations account for the mass of soil above the geomembrane or synthetic cover, and determine the uplift forces imparted by a positive pressure below the geomembrane or synthetic cover, i.e. within the waste mass.

For a design Factor of Safety equal to four (FS=4), the allowable positive pressure beneath the geomembrane or synthetic cover is 18 inches of water column (0.67 psig), based upon the approved final cover configuration. Extraction wells operated under these pressure conditions, and located within areas overlain by a geomembrane or synthetic cover will be considered compliant with §60.753(b)(2) and will not be considered a non-compliant operating condition.

4.6.2.4 Standard Operating Procedures for High Oxygen Wells

> §60.753(b)(3): "Operate the collection system with negative pressure at each wellhead except under the following conditions:
>
> (1) A fire or increased well temperature. The owner or operator shall record instances when positive pressure occurs in efforts to avoid a fire. These records shall be submitted with the annual reports as provided in 60.757(f)(1);
>
> (2) Use of a geomembrane or synthetic cover. The owner or operator shall develop acceptable pressure limits in the design plan;
>
> **(3) A decommissioned well. A well may experience a static positive pressure after shut down to accommodate for declining flows. All design changes shall be approved by the Administrator.**

Several of the wells at the Winnebago Landfill are located in waste that is over 20 years of age, with declining gas flow rates. A few wells in the existing system periodically have oxygen exceedances of greater than 5% when vacuum is applied. However, the facility does not yet want to permanently decommission these wells, since they may be needed for surface emissions control.

The site is therefore proposing a change to the standard operating procedure for these wells, as an alternative to permanently decommissioning them per §60.753(b)(3). Winnebago Reclamation Service, Inc. proposes to make the following changes to its standard operating procedure for wells where oxygen cannot be brought to below 5% even at reduced vacuums:

a. When the oxygen concentration at these wells do not decline to acceptable levels after more than one hour of reduced vacuum, the wells will be shut off until the gas quality recovers.
b. The monthly monitoring required by §60.755 will be conducted for wells that have been shut down, but positive pressure or elevated oxygen concentrations will not be considered nor reported as exceedances of the operating limits of §60.753.
c. If monthly monitoring indicates that pressure has built up in the wells and the oxygen concentration still exceeds five percent, the wells will be briefly opened to

relieve the pressure and will then be shut down until they are monitored the following month.

d. If the monthly monitoring indicates that gas quality has improved (i.e. the oxygen concentration has dropped below five percent), the wells will be brought back on line until the gas quality declines again.
e. The surface monitoring required under §60.755 will be conducted for wells that have been shut down. Standard remediation steps, including evaluating the need to return wells to full-time service, will be followed if exceedances of the 500 ppm methane surface concentration limits are detected.

Please note that this alternative standard operating procedure was approved by US EPA Region 4, at an NSPS landfill in Florida, on February 9, 2005.

4.6.2.5 Oxygen Metering Methods

> **§60.753(c)(2) Operational Standards for Collection and Control Systems:** "...oxygen shall be determined by an oxygen meter using Method 3A..."

When applicable, Winnebago Reclamation Service, Inc. is proposing to use an on-site multi-gas analyzer, in lieu of a laboratory method, for determining the oxygen content of the LFG at each well and monitoring point. The site will be using a portable meter, such as a GEM-500 or equivalent, calibrated to the manufacturer's specifications, to determine the oxygen content of the LFG. This is acceptable to and has previously been approved by USEPA.

4.6.2.6 Start up, Shutdown and Malfunction Plan

> **§60.755(e):** The provisions of this subpart apply at all times, except during periods of start-up, shutdown, or malfunction, provided that the duration of start-up, shutdown, or malfunction shall not exceed 5 days for collection systems and shall not exceed 1 hour for treatment or control devices.

It is impossible to respond to and fix most types of control device malfunctions in one hour or less. It is also impossible to do some types of control device maintenance in one hour or less. Similarly, repairs to the main header of the gas system may take more than 5 days depending on the scope of repairs and the weather.

The Landfill National Emissions Standards for Hazardous Air Pollutants (NESAHP) (40 CFR 63 Subpart AAAA) requires the preparation of a Start-up, Shutdown and Malfunction (SSM) Plan. The plan must detail the actions to be taken by the site in the event of an SSM event. The duration of each event must be recorded, and all such SSM events reported on a semiannual basis.

The facility is requesting that the one hour/five day shutdown limitations of the NSPS not apply to the facility now that the Landfill NESHAP has been promulgated. These events will now be governed by the more stringent SSM plan recordkeeping and reporting requirements of the Landfill NESHAP.

4.6.2.7 Monitoring at New/Extended Vertical Extraction Wells

§60.756: "Except as provided in §60.752(b)(2)(i)(B),

(a) Each owner or operator seeking to comply with §60.752(b)(2)(ii)(A) for an active gas collection system shall install a sampling port and a thermometer or other temperature measuring device at each wellhead and:

(1) Measure the gauge pressure in the gas collection header on a monthly basis as provided in §60.755(a)(3); and

(2) Monitor nitrogen or oxygen concentration in the landfill gas on a monthly basis as provided in §60.755(a)(5); and

(3) Monitor temperature of the landfill gas on a monthly basis as provided in §60.755(a)(5)."

New vertical LFG extraction wells are often placed in the active area of the landfill several years before the waste has reached final grades. This is in compliance with the NSPS. However, since the wells are placed in active areas, they periodically need to be "raised" (i.e. the well casing extended 15 to 25 feet vertically) in order to not be buried under lifts of trash. When they are raised, the HDPE lateral line which provides the applied vacuum is temporarily disconnected until the surrounding lift of trash is brought high enough to reconnect the well. The time frame between when a well is disconnected and raised, and when the waste height is high enough to reconnect the lateral, can often range from a few weeks to a few months. This can result in missed monthly readings at the well, since the well casing is too high for the technician to safely reach.

Since the NSPS allows for exclusion of surface monitoring in "dangerous areas" of the site, Winnebago Reclamation Service, Inc. believes it is reasonable to request exclusion to monitoring the wells raised in active areas. The facility proposes that readings will be missed at a particular well as long as the well cannot be safely accessed. If the facility cannot bring the waste height up to the new grade and re-attach the well within a reasonable amount of time (2 months), then modifications to the lateral/wellhead such as the well will be cut back down and re-attached will be made for monitoring. This request is in accordance with §60.752(b)(2)(i)(B), which allows the facility to propose alternatives to the monitoring procedures in the NSPS.

4.6.2.8 Monitoring for Air Intrusion

§60.753(c) requires nitrogen or oxygen to be monitored at each wellhead, but not both. It is understood by Winnebago Reclamation Service, Inc. that if either oxygen OR nitrogen was selected as the parameter to be monitored in the Design Plan or the permit, then the site must monitor for and comply with that parameter. If the site did not specify whether oxygen or nitrogen would be monitored, then the site must comply with both parameters where a GC is being used as measurement. Pursuant to this understanding, Winnebago Reclamation Service, Inc. will utilize oxygen as the selected parameter for determining air intrusion at the Winnebago Landfill.

4.6.2.9 Monitoring of New or Replacement Extraction Wells

GCCS's are typically built in phases to accommodate for additional waste placement as well as to replace various wells from time to time due to settlement, etc. Installation of only a few additional wells can cause challenges with balancing the entire GCCS and therefore additional time may be needed to not only achieve negative pressure in all wells but to also maintain the operating standard for oxygen, nitrogen and/or temperature.

Per §60.755(a)(4), the landfill is not required to expand the system during the first 180 days after gas collection system start-up where pressure exceedances were recorded at one or more wells. Therefore, Winnebago Reclamation Service, Inc. proposes a request for alternative timeline procedure as part of this Design Plan to bring new and replacement wells into compliance within 180 days of installation. During this time period, the extraction wells will be monitored, however they will not be subject to the operational and monitoring constraints under §60.753. In addition, Winnebago Reclamation Service, Inc. proposes that methane surface monitoring exceedances under 60.755 also be granted 180 days to be corrected without being required to expand the collection system in areas where new and replacement wells are installed.

4.6.2.10 Monitoring of Interim LFG Collectors

Winnebago Reclamation Service, Inc. proposes that when "extra" collectors are added or the leachate collection system is connected to the GCCS to control odors, to increase the quantity of LFG available for beneficial use, or to meet other landfill operating needs beyond regulatory compliance with the rule, that these "extra" collectors be excluded from the NSPS Operational Requirements. Since a professional engineer certified that the GCCS Design Plan would meet the required level of LFG control without the use of the "extra" collectors and the Administrator approved the Design Plan, Winnebago Reclamation Service, Inc. does not believe that the operating requirements should be beyond that required by the NSPS rule. Further, because these devices are installed for purposes other than to meet the requirements of the NSPS rule (i.e., odor control, energy recovery projects, etc), their design may preclude their ability to meet the stipulated operation requirements.

An example of this situation is when the leachate collection system is connected to the GCCS for odor mitigation purposes. Because the leachate collection layer extends close to the landfill surface and during initial cell development portions may even be exposed directly to air, a large amount of air can be drawn directly through the leachate system causing elevated oxygen concentrations at the wellhead. In this situation it is often impossible to limit the oxygen concentration to less than the regulatory standard of 5 percent. This, however, does not cause an operational problem as the air never moves through the waste and therefore does not increase the risk of a subsurface fire.

Another example is when LFG is collected from the leachate collection system and the leachate level rises above the perforated portion of the leachate collection riser pipe. In this situation, LFG does not move through the riser and an unrepresentative but elevated oxygen concentration can be measured if a small quantity of air accidentally enters the top of the riser.

Winnebago Reclamation Service, Inc. proposes that all "extra" GCCS connections to leachate collection system be excluded from the NSPS operating and monitoring requirements at the Winnebago Landfill. The facility will verify that these "extra" connections are not necessary for NSPS compliance by performing methane surface emissions monitoring in the area where the "extra" collector is located to demonstrate less than 500 ppm above background.

4.6.2.11 Gas Flow Monitoring at Flare

> §60.756(c) Monitoring of Operations: "Each owner or operator seeking to comply with Section 60.752(b)(2)(iii) using an open flare shall install, calibrate, maintain, and operate according to the manufacturer's specifications the following equipment:
>
> (1) A heat sensing device, such as an ultraviolet beam sensor or thermocouple, at the pilot light or the flame itself to indicate the continuous presence of a flame.
>
> (2) A device that records flow to or bypass of the flare. The owner or operator shall either:
>
> (I) Install, calibrate, and maintain a gas flow rate measuring device that shall record the flow to the control device at least every 15 minutes; or
>
> (ii) Secure the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration. A visual inspection of the seal or closure mechanism shall be performed at least once every month to ensure that the valve is maintained through the bypass line.

A close examination of the above "actual" NSPS language indicates that flow monitoring at an open flare (such as the one used at Winnebago Landfill) may be unnecessary for NSPS compliance purposes if the control device does not contain a bypass valve. The

apparent intent of the regulation was to show that flow was going to the flare, and not down a bypass line. If there is no bypass line present at a site, and all flow goes to the flare, then flow monitoring should not be required.

The most recent "Questions and Answers" Guidance Document (revised 5/02) posted by the USEPA on their Air Toxics Website for the Landfill NSPS (http://www.epa.gov/ttn/atw/landfill/landflpg.html) had the following guidance on this issue:

Gas Flow Monitoring

Question: The rule requires a gas flow rate measuring device that records the flow to the control device every 15 minutes or a lock and key to prevent bypass. The commenter stated that their systems are designed to shut everything off (e.g. the blower) if there is a problem, for example, with the flare. Can they disregard the gas flow/lock & key requirements as long as their system is designed with no means to bypass the control device?

Answer: The gas flow measurement or lock and key requirements would not apply to a system that is designed such that there is no physical means to bypass the gas flow before it reaches the control device.

The Winnebago Landfill gas collection and control system does not contain a bypass line. The system is designed and operated such that the blower shuts down and main valve closes (at the open flare) to prevent the escape of landfill gas if the control device is not operating.

4.6.2.12 NESHAP Annual Reports

> §60.757(f): Each owner or operator of a landfill seeking to comply with 60.752(b)(2) using an active collection system designed in accordance with 60.752(b)(2)(ii) shall submit to the Administrator annual reports of the recorded information in (f)(1) through (f)(6) of this paragraph.

The newly promulgated Landfill NESHAP requires that the annual NSPS report be submitted on a semiannual basis. However, the NSPS regulations still stipulate an annual frequency. The facility is proposing to submit reports per the NESHAP schedule (i.e. semiannual reports due March 1 and September 1, as required at other Illinois NSPS sites) vs. submitting one annual report.

4.6.2.13 Non Productive Areas

> §60.759(a)(3)(ii) Any nonproductive area of the landfill may be excluded from control, provided that the total of all excluded areas can be shown to contribute less than 1 percent of the total amount of NMOC emissions form the landfill. The amount, location, and age of the material shall be documented and provided to the Administrator upon request. A separate NMOC emissions estimate shall be made for each section proposed for exclusion, and the sum of all such sections shall be compared to the NMOC emissions estimate for the entire landfill.

Currently, the Winnebago Landfill has no nonproductive areas, therefore; no portions of the Winnebago Landfill will be excluded from the coverage of the GCCS under §60.759(a)(3)(ii) at this time.

However, as the age of the waste progresses, LFG generation decreases with time. Methane and carbon dioxide are the principle components of LFG generated under steady-state anaerobic conditions. As the organic mater is landfills begin to achieve biological stabilization, the interior of the landfill can revert back to partial anaerobic, partial aerobic condition. Under these conditions, or when large quantities of inert waste materials are present, oxygen and nitrogen may be naturally present in the landfill interior. The continued operation of gas extraction devices in these areas can result in the presence of oxygen and nitrogen in the gas stream in concentrations exceeding NSPS requirements. In these situations, GCCS adjustments or expansions will not reduce the oxygen and nitrogen concentrations at the LFG extraction wellheads. As such Winnebago Reclamation Service, Inc. is proposing an alternative to address the operation of the gas extraction devices within such nonproductive areas. This alternative is described in listed below. Alternatives and Compliance with §60.752(b)(2).

The intent of the NSPS is to reduce surface emissions of LFG. As such, the NSPS requires that a vacuum, and oxygen content of less than 5 percent by volume, be maintained at all LFG extraction wells while the GCCS is in operation. However, in some situations, the quality of the LFG extracted, while under a constant vacuum, can be detrimentally affected by certain site-specific conditions. As described above, the most common cause would be a well or wells placed in an area of the landfill containing extremely older waste materials or installed in an area containing large quantities of inert wastes, both of which could result in partial anaerobic, partial aerobic conditions. Despite continued efforts to minimize the air intrusion by reducing the applied vacuum at non-producing wells, the extracted LFG can continue to exhibit poor gas composition.

As such Winnebago Reclamation Service, Inc. is proposing an alternative operating and monitoring plan for those LFG extraction wells that are unable to obtain the NSPS performance requirements due to poor gas production or composition. The proposed alternative plan would classify active gas extraction wells that exhibit the following characteristics to be identified as non-producing wells:

- Gas extraction wells with three consecutive months of NSPS monitoring history when oxygen concentrations have remained above 5 percent by volume and the presence of the elevated oxygen cannot be attributed to a specific event or operating of the system.

- Methane surface emissions near the well are below the NSPS compliance standard of less than 500 parts per million (ppm) above background.

The following alternative monitoring plan will be implemented for those wells that have been identified as non-producing per the above criteria.

- Non-producing gas extraction wells will be exempt from NSPS operating requirements and will be indicated on the monthly monitoring reports.

- Non-producing gas extraction wells will continue to be monitored as part of the regular monthly monitoring regime, unless a formal submittal is approved by the IEPA for the well to be abandoned.

- Should static LFG concentrations at the well increase to those levels considered typical for anaerobic conditions, the wellhead control valve will be opened and the well will be operated in accordance with the operational standards specified in §60.753. If the well(s) return to the non-producing characteristics, the well(s) will again be shut off and deemed exempt from NSPS operations requirements.

- If methane surface emissions are measured above 500 ppm above background around the non-producing well, Winnebago Landfill, LLC, will conduct an evaluation of the area and implement corrective measures as required by §60.755(4), including the reactivation of the shut-off LFG extraction wells.

Winnebago Reclamation Service, Inc, is not seeking IEPA approval to decommission or abandon such wells. Instead, it is being proposed that such wells be placed on the alternative operating and monitoring plan and temporarily be removed from further NSPS operation and monitoring requirements

No other alternatives to the operational standards, test methods, procedures, compliance measures, monitoring, record keeping, or reporting provisions of §60.753 through §60.758 of the NSPS are proposed at this time

4.6.3 Specifications for Active Collection Systems

As stated in Sections 4.1 through 4.5 of this design plan, the GCCS proposed at the Winnebago Landfill complies with the specifications for active collection systems as stipulated in §60.759 of the NSPS. If future expansions of the GCCS are necessary, they will be designed to comply with the NSPS requirements or any approved alternatives.

4.6.4 Install a Landfill Gas Collection and Control System

> **§60.752(b)(2)(ii)** Install a collection and control system within 18 months of the submittal of the design plan under paragraph (b)(2)(i) of this section that effectively captures the gas generated within the landfill.
>
> **§60.752(b)(2)(ii)(A)(*2*)** Collect gas from each area, cell, or group of cells in the landfill in which the initial solid waste has been placed for a period of:
>
> **§60.752(b)(2)(ii)(A)(*2*)(*i*)** 5 years or more if active; or
>
> **§60.752(b)(2)(ii)(A)(*2*)(*ii*)** 2 years or more if closed or at final grade;

The GCCS was constructed within the prescribed schedule under §60.752(b)(2)(ii). Future expansions to the GCCS will proceed in accordance with the schedules under paragraphs (i) and (ii) of this section.

> **§60.752(b)(2)(ii)(A)(*3*)** Collect gas at a sufficient extraction rate;
>
> **§60.752(b)(2)(ii)(A)(*4*)** Be designed to minimize off-site migration of gas.

In compliance with §60.752(b)(2)(ii)(A)(*3*) and (*4*), the GCCS is designed to extract LFG at a sufficient rate so as to minimize the subsurface lateral migration and surface emissions of LFG. This is achieved by sizing and installing sufficient collection elements, transmission piping, blower(s), and LFG destruction equipment for the estimated maximum flow rate of LFG.

The GCCS is designed to collect LFG at a sufficient rate, which per the definition in §60.75.1 means to maintain a negative [gage] pressure (vacuum) at all wellheads without causing air infiltration. Application of a negative gage pressure and minimization of air infiltration will be verified by monitoring the static pressure and nitrogen or oxygen concentrations of the LFG at the extraction points.

Each extraction point will be monitored on a monthly basis in accordance with 40 CFR §60.753 (b) and (c). Monitoring will be performed for pressure, temperature, oxygen and/or nitrogen, at a minimum.

Verification of the GCCS's ability to minimize off-site subsurface LFG migration is achieved through the routine quarterly perimeter monitoring for combustible gases at the site.

Winnebago Reclamation Services, Inc. will monitor the GCCS extraction points, after installation, for static pressure and for LFG quality in accordance with NSPS requirements. If off-site LFG migration is detected, Winnebago Reclamation Services, Inc. will take the necessary actions in accordance with NSPS requirements.

4.6.5 Control Systems

> **§60.752(b)(2)(iii)**Route all the collected gas to a control system that complies with the requirements in either paragraph (b)(2)(iii)(A), (B) or (C) of this section.

The existing LFG control device facilities, currently a landfill gas-to-energy facility and utility flares, have the ability to handle the maximum LFG generation capacity. The LFGTE facility is rated for 1,936 standard cubic feet per minute (scfm). The utility flares are rated for 3,290 scfm. The total LFG that can be treated is 5,226 scfm. The required operational performance of these components are stipulated by §60.752(b)(2)(iii) which states:

> **§60.752(b)(2)(iii)(A)** An open flare designed and operated in accordance with §60.18
>
> **§60.752(b)(2)(iii)(B)** A control system designed and operated to reduce NMOC by 98 weight-percent, or, when an enclosed combustion device is used for control, to either reduce NMOC by 98 weight percent or reduce the outlet NMOC concentration to less than 20 parts per million by volume, dry basis as hexane at 3 percent oxygen. The reduction efficiency or parts per million by volume shall be established by an initial performance test, required under §60.8 using the test methods specified in §60.754(d).
>
> **§60.752(b)(2)(iii)(C)** Route all collected gas to a treatment system that processes the collected gas for subsequent sale or use. All emissions from any atmospheric vent from the gas treatment system shall be subject to the requirements of paragraph (b)(2)(iii)(A) or (B) of this section.

The existing open flare at the Winnebago Landfill is designed to reduce the concentration of the NMOCs present in the LFG by at least 98 percent by weight. This reported destruction efficiency is further supported by emissions rate estimates performed by the flare manufacturers on similar units, and compliance with the restrictions in 40 CFR §60.18 for non-assisted flares. The establishment of the destruction efficiencies per the requirements of §60.8 [using the test methods specified in §60.754(d)] will be completed upon request of the IEPA.

Per §60.752(b)(2)(iii)(A), the open flare will be operated within the parameter ranges established by the manufacturer of this unit(s). They will be operated in such a manner as to meet the emission requirements of the NSPS and as stated in §60.18.

The location of the LFGTE facility can be seen on the design drawings located in Appendix C. The facility consists of four (4) reciprocating internal combustion engines. The engines utilize collected landfill gas as a fuel to generate electricity. Any overflow of landfill gas will be directed to the landfill gas flares as shown on the site plan drawings.

In accordance with §60.756(c)(1) of the NSPS, the LFG flow rate and the presence of flame will be monitored continuously. To insure the presence of a flame, either a thermocouple installed at the flare tip or a UV sensor shall be utilized. The LFG flow rate will be monitored using a thermal mass flow meter, or equivalent monitoring device, installed along the LFG piping, downstream of the blowers.

In accordance with §60.756(c)(1) of the NSPS, the LFG flow rate and the presence of flame will be monitored continuously at each LFG control device, when they are in operation.

5 LIMITATIONS

The work product included in the attached was undertaken in full conformity with generally accepted professional consulting principles and practices and to the fullest extent as allowed by law we expressly disclaim all warranties, express or implied, including warranties of merchantability or fitness for a particular purpose. The work product was completed in full conformity with the contract with our client and this document is solely for the use and reliance of our client (unless previously agreed upon that a third party could rely on the work product) and any reliance on this work product by an unapproved outside party is at such party's risk.

The work product herein (including opinions, conclusions, suggestions, etc.) was based on the situations and circumstances as found at the time, location, scope and goal of our performance and thus should be relied upon and used by our client recognizing these considerations and limitations. Cornerstone shall not be liable for the consequences of any change in environmental standards, practices, or regulations following the completion of our work and there is no warrant to the veracity of information provided by third parties, or the partial utilization of this work product.

APPENDIX A-1

GAS GENERATION RATE MODELING

(LANDGEM V3.02)

COMPUTATION SHEET

PROJECT TITLE:	Northern Expansion	PROJECT NO:	090043
DESCRIPTION:	GCCS Design Plan	SHEET:	1
	Landfill Gas Modeling Projections	OF:	3
PREPARED BY:	PJL	CHECKED BY:	AMK
DATE:	9/10/2009	DATE:	9/10/2009

Given:

Landfill gas generation projections have been made utilizing the USEPA's Landfill Gas Emission Model (LandGEM) V3.02. LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of land filled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_0 \left[\frac{M_i}{10}\right](e^{-kt_{ij}})$$

Where:

Q_{CH4} = annual methane generation in the year of the calculation ($m^3/year$)

i = 1-year time increment

n = (year of the calculation) - (initial year of waste acceptance)

j = 0.1-year time increment

k = methane generation rate ($year^{-1}$)

L_o = potential methane generation capacity (m^3/Mg)

M_i = mass of waste accepted in the i^{th} year (Mg)

t_{ij} = age of the j^{th} section of waste mass M_i accepted in the i^{th} year (*decimal years*, e.g., 3.2 years)

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate.

Site Conditions:

Waste conditions at the Winnebago Landfill Northern Expansion have been developed based upon recorded documentation and reports from site operations personnel.

from CP # 09080052 ?

WINNEBAGO LANDFILL

ROCKFORD, ILLINOIS

NORTHERN EXPANSION
LANDFILL GAS COLLECTION AND CONTROL SYSTEM
DESIGN PLAN

Prepared for

WINNEBAGO LANDFILL COMPANY, LLC

Winnebago Reclamation Service, Inc.

Winnebago Reclamation Service, Inc.

September 2009

Prepared by

CORNERSTONE
Environmental Group, LLC

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Bolingbrook, IL 60440
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Project 090043

CONTENTS

CONTENTS (Continued)

APPENDICES

TABLE 1 SUMMARY OF LANDFILL GAS COLLECTION AND CONTROL SYSTEM DESIGN PLAN

Regulatory Citation	*Report Reference*	*Appendix E Reference* [1]	*Regulatory Requirement*	*Implementation of Regulatory Requirement*
§60.759 (a)(1)	Section 1.3	Page E-3, Section 2	Landfill gas collection and control system design plan must be certified, sealed and signed by a professional engineer.	Landfill gas collection and control system design plan has been certified, sealed and signed by a professional engineer.
	Section 4-1	Page E-3, Section 3	Design Plan must address depth of refuse, refuse gas generation rates and flow characteristics, cover properties, gas system expandability, leachate and condensate management, accessibility, compatibility with filling operations, integration with closure end-use, air intrusion control, corrosion resistance, fill settlement, resistance to the refuse decomposition heat.	The Winnebago Landfill design plan addresses all of the requirements listed under §60.759 (a)(1).
§60.759 (a)(2)	Section 4-2	Page E-3, Section 4	Landfill gas collection devices shall be installed at a sufficient density to control surface emissions and subsurface migration of landfill gas.	The current landfill gas collection devices have been designed to control surface emissions and subsurface migration of landfill gas.
§60.759 (a)(3)(i)	Section 4-3.1	Page E-3, Section 5	Areas containing asbestos or other non-degradable materials may be excluded from coverage by the landfill gas collection and control system	No segregated, i.e. mono-fill, areas containing asbestos or non-degradable materials are know to exist at the site, therefore no areas of the landfill have been excluded from the coverage of the landfill gas collection and control system.
§60.759 (a)(3)(ii)	Section 4-3.1	Page E-3, Section 6	Areas considered to be non-productive (contributing less than 1 percent of the total non-methane organic compounds from the landfill) may be excluded from coverage of the landfill gas collection and control system.	No areas of the landfill are known to be non-productive at this time, therefore no areas of the landfill have been excluded from the coverage of the landfill gas collection and control system.

Regulatory Citation	*Report Reference*	*Appendix E Reference* [1]	*Regulatory Requirement*	*Implementation of Regulatory Requirement*
§60.759 (b)(1)	Section 4-4.1	Page E-5, Section 7	Landfill gas collection and control system components shall be constructed of PVC, HDPE or other non-porous corrosion resistant materials.	Landfill gas collection and control system components shall be constructed of PVC, HDPE or other non-porous corrosion resistant materials.
	Section 4-4.1	Page E-5, Section 8	Landfill gas collection and control system components shall have suitable dimensions to convey the maximum landfill gas flow rate and withstand future settlement, overburden and traffic loads.	Landfill gas collection and control system components were designed to accommodate the maximum landfill gas flow rate and withstand future settlement, overburden and traffic loads.
	Section 4-4.1	Page E-5, Section 9	Expansion of the landfill gas collection and control system will occur as needed to meet landfill gas emissions and migration standards.	Expansion of the landfill gas collection and control system will occur as needed to meet landfill gas emissions and migration standards.
	Section 4-4.1	Page E-5, Section 10	Extraction well perforations will control head loss and air infiltration throughout the system.	The landfill gas collection elements are perforated to minimize head loss and prevent excessive air infiltration into the system.
§60.759 (b)(2)	Section 4-4.2	Page E-5, Section 11	Extraction wells must not endanger the landfill base liner and must address the occurrence of water in the landfill.	The landfill gas extraction wells are designed and installed to extend from the landfill surface to approximately 75 percent of the waste thickness unless otherwise designed by an engineer, but no closer than 10 feet to the base liner. Liquids in the refuse are addressed by the leachate and condensate management systems.
	Section 4-4.2	Page E-6, Section 12	Suitable cross-section of the well holes and trenches is required for construction and completion of the collection elements.	The vertical boreholes and/or interim horizontal trenches will be constructed with sufficient cross section to allow for the proper construction of the collection elements.

Regulatory Citation	*Report Reference*	*Appendix E Reference* [1]	*Regulatory Requirement*	*Implementation of Regulatory Requirement*
§60.759 (b)(2)	Section 4-4.2	Page E-6, Section 13	Landfill gas collection and control system components must be designed to control air intrusion, prevent landfill gas from escaping the collection system, and prohibit refuse from entering the collection system.	Control of air intrusion and the escape of landfill gas from the system will be accomplished through the monitoring of the landfill gas collection and control system, operating the system under vacuum and continued maintenance of the landfill cover. The refuse is prohibited from entering the collection devices by gravel backfill or other approved materials placed in the hole or trench separating the refuse from the landfill gas collection elements.
	Section 4-4.2	Page E-6, Section 14	Gravel backfill in the extraction wells and trenches shall not obstruct pipe perforations.	Backfill of sufficient size will be used to prohibit entry or blockage of the collector perforations.
§60.759 (b)(3)	Section 4-4.3	Page E-6, Section 15	Collection device connections may be above or below ground, must include a positive closing throttling valve, necessary seals, access couplings, and at least one monitoring point.	The collection devices are connected to the collection header pipe and include a positive closing throttling valve, necessary seals, access couplings, and a minimum of one monitoring point.
§60.759 (c)	Section 4-5	Page E-6, Section 16	The collection header pipes must be adequate to handle the maximum landfill gas flow rate.	The collection header pipes are sized to adequately handle the maximum landfill gas flow rate.
§60.752 (b)(2)(ii)(A)(*2*)	Section 4-6.4	Page E-2, Section 2	Landfill gas collection shall occur in active cells with waste in place for five years or more; in closed cells with waste at final grade for two years or more.	The landfill gas collection and control system components will be installed per NSPS schedule requirements.
§60.752 (b)(2)(ii)(A)(*3*)	Section 4-6.4	Page E-2, Section 3	Landfill gas extraction wells shall apply a negative gage pressure to maintain a sufficient extraction rate of landfill gas without causing air infiltration.	A negative gage pressure is applied to the landfill gas collection elements via centrifugal blowers. The landfill gas collection system wellheads will be monitored for static pressure and indications of air infiltration.
§60.752 (b)(2)(ii)(A)(*4*)	Section 4-6.4	Page E-2, Section 4	Subsurface migration of landfill gas will be controlled.	The landfill gas collection and control system shall control subsurface migration and be verified by the monitoring of perimeter monitoring stations installed at the site.

TABLE 2 - LANDFILL GAS COLLECTION AND CONTROL SYSTEM (GCCS) DESIGN REVIEW CHECKLIST

Landfill Site Name: Winnebago Landfill
Location of Landfill: Rockford, Illinois
Landfill Owner: Winnebago Reclamation Services, Inc.
Date of Submittal: September 2009

Goals for the GCCS: (control migration) (control emissions) (safety)

(circle all that apply, add more as appropriate)

Is the GCCS proposed to be (active) or passive? (circle one)

The existing and proposed GCCS is active in nature and should serve to mitigate the potential for both subsurface and airborne migration, as well as the potential for accumulation in occupied structures.

---

1. Was the design certified by a PE? **60752(b)(2)(i)** (Yes) No
(circle one)

   Angela M. Krueger is a Registered Professional Engineer in Illinois and has certified this Design Plan as the design engineer. Please reference Section 1 of the Design Plan.

2. Was the design submitted within 12 months of the ~~first~~ report of the site exceeding 50 Mg/yr. of NMOC's? **60.752(b)(2)(i)** (Yes) No
(circle one)

   If no, describe circumstances: *On behalf of Winnebago Reclamation Services, Inc., Cornerstone Environmental Group, LLC has prepared this landfill gas collection and control system (GCCS) Design Plan for the Northern Expansion Area.*

3. Is the GCCS planned to be operational within 30 months of the first report of the site exceeding 50 MG/yr. of NMOC's? **60.752(b)(2)(ii)** Yes (No)
(circle one)

If no, describe circumstances: *At the time of this report, an active GCCS has been constructed and is operating at the Winnebago Landfill.*

4. Does the GCCS comply with the 2 year/5 year rule? **60.752(b)(2)(ii)(A)(2)**
(Yes) No
(circle one)

If no, describe circumstances:
Please Reference Section 4.6.4 of the Design Plan.

5. What is the design life of the GCCS? **60.752(b)(2)(v)** _____
(If less than 15 years describe why) *The design life of the GCCS includes both the operational period of the facility and the post-closure period while landfill gas (LFG) is still being generated in quantities that require environmental control. Individual components of the GCCS will be replaced or repaired as age and usage reduce their efficiency.*

6. Is the GCCS design for the maximum expected flow rates during its design life?
60.752(b)(2)(ii)(A)(1) (Yes) No
(circle one)

If no, describe circumstances:
Please reference Section 4.5 of the Design Plan.

7. Describe the measures taken to control lateral LFG migration in the design. If no measures were taken, describe why? **60.752(b)(2)(ii)(A)(4)** *The design of the GCCS uses active extraction to mitigate the potential for lateral LFG migration. This process is enhanced by the presence of a flexible membrane liner (FML) base liner system. Please reference Section 4.1 of the Design Plan.*

8. If a passive system is planned, are the necessary liners in place?
60.752(b)(2)(ii)(B)(2) Yes No
(circle one)

If no, describe circumstances:
Not Applicable – an active system is existing and proposed.

9. Is adequate density of collectors planned? Refer to Section 5.1 (Yes) No
(circle one)

If no, describe circumstances:
Please reference Section 4.2 of the Design Plan.

10. Is the LFG Conveyance System sized properly? Refer to Section 5.2
(Yes) No
(circle one)

The LFG conveyance system is adequately sized to handle the current LFG generation rate as determined using the United States Environmental Protection Agency (USEPA) LandGEM V3.02 and is expandable. The LFG conveyance system will be expanded to handle future LFG generation rates in accordance with the New Source Performance Standards (NSPS) to mitigate surface and lateral LFG migration. Please reference Sections 4.4.1.2 and 4.6.5 the Design Plan.

11. Is the LFG planned to be routed to a control device? **60.752(b)(2)(iii)**
(Yes) No
(circle one)

Please reference Section 4.6.5 of the Design Plan.

12. Describe the control device (utility flare) enclosed flare (other)
(circle one)

The control device is an existing landfill gas-to-energy facility sized for 1,936 standard cubic feet per minute (scfm) and utility flares sized for 3,290 scfm total. The flares will be operated in accordance with §60.18. Please reference Section 4.6.5 of the Design Plan.

13. If the control device is a flare, does it include continuous temperature monitoring and a flow measurement device? **60.756(b) and (c)** (Yes) No
(circle one)

If no, describe circumstances:

14. Is the flare sized properly? Refer to section 5.3 of the student manual.
(Yes) No
(circle one)

The flares are sized for a total gas generation potential of 3,290 scfm, greater than the design flow rate in accordance with §60.752(b)(2)(iii)(B). Please reference Section 4.6.5 of the Design Plan.

15. If a control device other than a flare is planned, describe the estimated hours and duration it will be down for maintenance per year:

The LFGTE plant will have a regular maintenance schedule.

16. Operational Issues **60.753(b), (c), (d), (e), (f)**
Will the GCCS be operated with a vacuum at every well? (Yes) No

The GCCS will be operated with a vacuum at each extraction point, with the exception of mitigating circumstances under §60.753(b)(1).

17. Will the GCCS be operated at the appropriate gas temps? (Yes) No

The GCCS is intended to operate at LFG temperatures below 55°C (131°F).

18. Will the GCCS be operated with minimal amounts of air? (Yes) No

The GCCS is designed to prevent excessive air infiltration. Please reference Section 4.1.10 of the Design Plan.

19. Will monitoring be done monthly to confirm these operational issues?
(Yes) No

Monitoring will be conducted in accordance with NSPS requirements. Please reference Section 4.2 of the Design Plan.

20. Will surface emissions monitoring be completed? (Yes) No

Monitoring will be conducted in accordance with NSPS requirements. Please reference Section 4.2 of the Design Plan.

21. Will the blower automatically be shutdown if the control device is inoperable?
(Yes) No

The blower system will automatically be shut down if the control device becomes inoperable. Please reference Section 4.6.5 of the Design Plan.

22. Does the GCCS include fittings to allow connection of additional collectors if necessary in the future? **60.756(2)** (Yes) No
(circle one)

If no, describe circumstances: *The header system will incorporate blind flanges along the transmission piping to facilitate expansion of the system. Additionally, high density polyethylene (HDPE) piping can be readily modified to accept tees or other fittings necessary for system expansion.*

Does the wellhead for all collectors include at least one sample port and one thermometer port? 60.756(2) Yes No

(circle) one)

If no, describe circumstances: *The wellheads for all collectors will include at least one sample port and one thermometer port. Please reference Section 4.6.4 and Appendix C of the Design Plan.*

1 INTRODUCTION AND CERTIFICATION

1.1 Purpose

The purpose of this document is to provide a design plan in accordance with the New Source Performance Standards (NSPS) design requirements for the landfill gas (LFG) collection and control system (GCCS) at the Winnebago Landfill Facility. The Illinois Environmental Protection Agency (IEPA) ID Numbers are for Land 2018080001 and Air 201801AAF. This document serves as the GCCS Design Plan and was prepared pursuant to 40 Code of Federal Regulations (CFR) Part 60, Subpart WWW, and NSPS for Municipal Solid Waste Landfills and 35 Ill Administration Code 811.311 and 811.312.

1.2 Compliance Summary Table

A summary of the pertinent NSPS regulations and implementation of these regulations at the Winnebago Landfill is presented in Table 1 of this Design Plan. Additionally, location references of the regulations in this Design Plan and in Appendix E of the NSPS enabling document are presented.

1.3 Certification

This NSPS Design Plan for the GCCS at the Winnebago Landfill has been prepared by Cornerstone Environmental Group, LLC (Cornerstone), as authorized by Winnebago Landfill Company, LLC and Winnebago Reclamation Services, Inc. which respectively own and operate the Municipal Solid Waste (MSW) Landfill. I certify that the GCCS as described in this plan meets the design requirements specified in 40 CFR §60.759 and any alternatives pursuant to 40 CFR §60.752(b)(2). I further certify that this Design Plan was prepared by me or under my direct supervision, and that I am a duly registered Professional Engineer.

Angela M. Krueger, P.E.
IL P.E. No. 062-058348

2 EXISTING SITE CONDITIONS

2.1 Landfill Description

The Winnebago Landfill Facility is located in Rockford, Illinois. The Winnebago Landfill Facility is owned by Winnebago Landfill Company, LLC and operated by Winnebago Reclamation Services, Inc.

The Winnebago Landfill Facility consists of multiple waste disposal units . They are the North Expansion unit, the North unit and the South unit. The North and South units have existing GCCS in place. The purpose of this document is to establish the GCCS design plan for the Northern Expansion and document the emission increase associated with the construction of the North Expansion unit.

The Northern Expansion has a total permitted landfill area of 66.6 acres, which is the permitted disposal area. Waste placement, which began in 2008, is expected to continue through 2020, given current rate of waste acceptance. The Northern Expansion has a waste capacity of approximately 9.28 million megagrams (Mg) (10.2 million tons). The Northern Expansion is underlain with a Subtitle D liner system with a flexible membrane liner (FML). The final cover system will consist of a composite geosynthetic/low permeability soil barrier.

2.2 Landfill Gas Collection and Control System

Winnebago Landfill currently has an active GCCS installed and operating as required by NSPS in the North and South Units. Waste placement activities began in the Northern Expansion in 2008, and it is anticipated to reach capacity in 2020 at current filling rates. The GCCS design presented in this document pertains to the Northern Expansion, as it will continue waste placement activities, and will expand the existing GCCS as required by NSPS.

This section identifies proposed components for the GCCS at the Winnebago Landfill. The proposed design consists of vertical wells and interim/supplemental horizontal trenches, if warranted, to extract LFG from the disposal areas.

The proposed vertical extraction wells will have a well spacing ranging from 200 to 250 feet throughout the waste fill areas. Interim/supplemental horizontal collection trenches may also be utilized in areas that will not reach final grade within five years of initial waste deposition. Interim/supplemental horizontal collection trenches allow extraction of LFG from areas that are not easily accessible to vertical wells. Interim/supplemental horizontal collectors may be utilized in waste less than five years old to collect LFG once a sufficient barrier of waste (approximately 15 feet) is placed above the collector to reduce the potential for air infiltration. If utilized, trenches will be spaced at a frequency of approximately 150 to 300 feet horizontally and approximately 20 to 60 feet vertically.

Although no sections of the disposal area have been designated for the construction of horizontal LFG collection trenches, Winnebago Reclamation Services, Inc. reserves the right to install additional components should future operational concerns dictate the need in other areas of the landfill.

Permanent lateral and header pipes are installed generally below ground surface and typically constructed of high density polyethylene (HDPE) pipe. Temporary piping may be installed either above or below ground surface. Currently LFG is conveyed through this pipe network to a landfill gas-to-energy (LFGTE) facility and utility flares. Condensate that is formed in the Northern Expansion will be collected in barometric traps in the collection piping and condensate pump stations. The condensate will drain from these traps to the facility's Leachate Collection System (LCS) via direct connections to the LCS cleanout/access risers. The condensate will be disposed of coincidentally with landfill leachate in accordance with the requirements of the facility solid waste permit.

Additional information and drawings of the GCCS are included in Appendix C.

3 FUTURE SITE DEVELOPMENT

3.1 Landfill Development Plan

Winnebago Reclamation Services, Inc. will continue waste filling operations at the Northern Expansion in accordance with the solid waste permit. Installation of additional GCCS components is anticipated to be coordinated with fill development and as otherwise required by NSPS regulations regarding installation of GCCS components stipulated in §60.752(b)(2)(ii)(A)(2). Due to operational changes, the GCCS design presented in Appendix C may be altered to maintain compliance with the provisions of the NSPS and to accommodate actual field conditions at the time of construction.

3.2 Landfill Gas Control System Expansion Capabilities

The GCCS will be designed to be readily expanded as fill operations proceed. Vertical wells will typically be installed in areas that have reached final grade. Vertical wells and/or interim/supplemental horizontal collection trenches will be installed as an interim control measure in disposal areas that that are not yet at final refuse grades.

Vertical extraction wells installed prior to reaching final grade will either be extended to the final grade level or abandoned and replaced. This determination will be made based upon the physical condition of the wells, their ability to provide effective LFG extraction, and field conditions at the time of final cap installation.

LFG headers will be sized to accommodate the maximum expected flow, and be fitted with flanged tees for expansion as new collectors are installed, in accordance with NSPS requirements. Additionally, the use of HDPE header piping provides for flexible and efficient connections for future expansion of the header piping system.

In the event that actual LFG flows exceed the capacity of the LFG control device, additional control device capacity will be added to handle the LFG flows. The LFG treatment area was designed to allow for the addition of additional LFG control device capacity as warranted.

4 COMPLIANCE REVIEW AND EVALUATION

4.1 Compliance with §60.759(a)(1)

> §60.759(a)(1) The collection devices within the interior and along the perimeter areas shall be certified to achieve comprehensive control of surface gas emissions by a professional engineer. The following issues shall be addressed in the design: depths of refuse, refuse gas generation rates and flow characteristics, cover properties, gas system expandability, leachate and condensate management, accessibility, compatibility with filling operations, integration with closure end use, air intrusion control, corrosion resistance, fill settlement, and resistance to the refuse decomposition heat.

The GCCS has been designed to be consistent with NSPS requirements to achieve comprehensive control of both lateral migration and surface emissions of LFG.

Issues related to compliance with §60.759(a)(1) are discussed in the following sections.

Applicable information used in the design of the GCCS is included in Appendix A (A-1: Gas Generation Rate Modeling, A-2: Radius of Influence and Well Spacing Calculations, A-3: Condensate Generation Estimates, and A-4: Positive Pressure Allowances), Appendix B (Head Loss Analysis), Appendix C (GCCS Design Plans), and Appendix D (Surface Emissions Monitoring Plan).

4.1.1 Control of Surface Emissions

The GCCS is designed to minimize both subsurface lateral migration and surface emissions of LFG from the Winnebago Northern Expansion Landfill. System performance depends upon the installation of a satisfactory GCCS system, its proper management, and maintenance of a suitable final refuse cover system. If there is a temporary exceedance in emissions it will be addressed by appropriate response, evaluating both the GCCS and final cover systems. Appropriate action will then be taken to correct the exceedance, as required by NSPS.

4.1.2 Depths of Refuse

Depths of refuse were calculated, at the time of the design of the GCCS, based upon existing topography, final development permit plan, and record documentation of landfill liner grades. The landfill surface elevation was determined from aerial survey data at the time of design.

4.1.3 Landfill Gas Generation Rates and Flow Characteristics

In compliance with §60.752(b)(2)(ii)(A), the maximum expected LFG flow rate for the Northern Expansion was used for sizing the GCCS. The LFG generation rate calculations were performed using the United States Environmental Protection Agency (USEPA) Landfill Gas Emission Model (LandGEM) (AP-42 default values of k=0.04/year and L_0=100 m^3/Mg), historical waste receipts and the permitted design capacity of the facility.

The maximum LFG generation rate for the Northern Expansion was calculated to be approximately 3,947 scfm in 2021. The current LFG generation estimate for 2009 is 119 scfm.

The proposed GCCS components to be installed in the Northern Expansion shall be sized to accommodate a LFG flow rate of 3,947 scfm. As discussed in Section 3.2 of this Design Plan, the GCCS will be installed in a manner to allow expansion of the wellfield, piping, and LFG control device capacity as actual LFG flows increase as landfilling continues at the site.

The LandGEM emissions model is a "design tool," which uses the information available to project future operating conditions. This model was developed based upon operating conditions at a cross-section of landfills within the United States, and is approved for use by the USEPA. Actual operating parameters may dictate changes in the system flow characteristics and process equipment as the system is developed. These changes will be made in accordance with §60.752.

Landfill gas generation projections are provided in Appendix A.

4.1.4 Landfill Cover Properties

The proposed final landfill cover at the Northern Expansion will incorporate a composite geosynthetic/low permeability soil barrier. The primary purpose of the final cover system unit is to preclude precipitation infiltration that would generate additional leachate. However, the final cover system design also provides a significant barrier to LFG

emission and air infiltration when combined with an active LFG extraction system. The GCCS will provide components for collecting LFG or relieving pressures from LFG from beneath the landfill covers.

4.1.5 Landfill Gas Control System Expandability

Expandability of the GCCS is achieved by installing tees with blind flanges along the transmission piping or providing expansion capabilities for additional LFG control devices. These flanges or expansion points provide planned access for expansion of the LFG transmission piping and LFG control device facility in the future. In the event that actual LFG flow rates do exceed the capacity of the system, additional GCCS components will be designed and installed in accordance with IEPA requirements.

4.1.6 Leachate and Condensate Management

Leachate management at the Northern Expansion Landfill is accomplished through the use of an engineered leachate collection and management system (LCS). Leachate is pumped from the LCS for off-site treatment and disposal. The LCS is designed according to Subtitle D standards (40 CFR§257 and §258) and is part of the Solid Waste Disposal Permit.

LFG piping grades will be maximized where practical to reduce the impact of differential settlement and promote positive condensate drainage. Proposed transmission header and lateral piping will be sloped at a minimum of 3 percent within waste limits (0.5 percent outside waste limits), unless otherwise denoted, to promote condensate to flow by gravity to engineered low points in the GCCS piping, for collection of the condensate. Condensate collected at the engineered low points will be handled by pump stations or engineered gravity drains that will discharge directly into the LCS. Areas outside the Subtitle D liner system will collect condensate in pump stations, for periodic discharge to the LCS within the Subtitle D area via a force main(s).

4.1.7 Accessibility

Accessibility to the GCCS components is achieved by installing commonly accessed components (such as wellheads and monitoring ports) on relatively flat surfaces of the landfill or near the landfill's road network. Wellheads, piping risers, valves and monitoring ports will be installed above grade, or within vaults, to maintain accessibility.